

# PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 11 October 2001 (11.10.01)	
<b>International application No.</b> PCT/US01/00276	<b>Applicant's or agent's file reference</b> BT-001APCT
<b>International filing date</b> (day/month/year) 05 January 2001 (05.01.01)	<b>Priority date</b> (day/month/year) 06 January 2000 (06.01.00)
<b>Applicant</b> HOY, Edgar, Franklin	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

20 July 2001 (20.07.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Christelle CROCI</p> <p>Telephone No.: (41-22) 338.83.38</p>
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## PATENT COOPERATION TREATY

## PCT

REC'D 25 JUN 2002

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference BT-001APCT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US01/00276	International filing date (day/month/year) 05 January 2001 (05.01.2001)	Priority date (day/month/year) 06 January 2000 (06.01.2000)
International Patent Classification (IPC) or national classification and IPC IPC(7): B01J 13/00; C01B 33/20; C04B 33/04 and US Cl.: 516/110; 507/129, 131, 140, 239, 244, 269; 252/184		
Applicant HOY, EDGAR FRANKLIN		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

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Date of submission of the demand 20 July 2001 (20.07.2001)	Date of completion of this report 14 May 2002 (14.05.2002)
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer <i>Daniel S. Metzmaier</i> Daniel S. Metzmaier Telephone No. (703) 308-0661

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US01/00276

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed.
- ☒ the description:  
pages 1-32 as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☒ the claims:  
pages 33-36, as originally filed  
pages NONE, as amended (together with any statement) under Article 19  
pages 37-39, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☒ the drawings:  
pages 1-5, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☐ the sequence listing part of the description:  
pages NONE, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages NONE
- ☐ the claims, Nos. NONE
- ☐ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/US01/00276

## V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. STATEMENT

Novelty (N)	Claims <u>1-17, 20-24, 30-34 and 42-48</u>	YES
	Claims <u>18-19, 25-29 and 35-41</u>	NO
Inventive Step (IS)	Claims <u>30-34 and 42-48</u>	YES
	Claims <u>1-48</u>	NO
Industrial Applicability (IA)	Claims <u>1-48</u>	YES
	Claims <u>NONE</u>	NO

### 2. CITATIONS AND EXPLANATIONS

Please See Continuation Sheet

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the questions whether the claims are fully supported by the description, are made:

The description is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 5 because it fails to contain an adequate written description of M defined to include Group IA elements such as H<sup>+</sup>, Li<sup>+</sup>, Na<sup>+</sup>, K<sup>+</sup>. The description is inadequate because: M' and M" set forth in structure of claim 1 and at page 8 of the specification are defined as divalent and trivalent metal cations which do not include Group IA elements.

Claims 1-24 are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claims 1-24 are indefinite for the following reason(s): Claim 1 is indefinite regarding the meats and bounds of the material or materials encompassed by the scope of the empirical formula set forth therein. Initially, applicants modify the structure set forth in claim 1 as "material or materials whose constituents substantially conform to the proportions of the empirical formula". It is unclear what proportions which are not set forth are intended by applicant. The metes and bounds of compounds which differ from the explicit structure is indefinite regarding how they differ and to what extent they differ.

The breadth of the ions forming the empirical overlap rendering the scope of materials encompassed indefinite. The ion OH<sup>-</sup> is a monovalent ion which reads on A or B as now claimed. It is unclear for ions A or B which may be OH<sup>-</sup>, how the skilled artisan should interpret the proviso statements defining  $qa + br$  cannot be greater than  $2m + 3n$ ,  $qa$  cannot equal  $2m + 3n$ , and  $(2m + 3n + qa + br)$  is less than 3.

Claim 1 is indefinite regarding the scope of the terms M' because the claim defines said compounds as divalent while the specification which also defines said element as divalent includes Group IA elements as possible materials therefore. Said material would not be monovalent.

Claim 2 is confusing because while M' and M" are provided for in claim 1, M is not provided for and lacks antecedent basis therein. Does applicant intend "M'" or "M"? Please contrast with disclosure at the paragraph bridging pages 7 and 8. Regarding the said recitation at page 8, it is not seen how Group IA can be said to define divalent metal cations.

In claim 4, it is unclear whether "calcined" modifies only "hydrotalcite" or "hydrotalcite, hydrotalcite-like compound, or mixtures thereof". Furthermore, it is unclear what are the metes and bounds of the term "hydrotalcite-like compound" since it is unclear what compounds are encompassed by said language and how said "like" compounds differ from hydrotalcite.

In claim 11, it is unclear wherein the method further comprises the materials set forth therein. It is suggested applicants include an active step such as -- adding -- after "comprising" or set forth wherein the method incorporates the claimed compounds, i.e., -- said materials --, -- said clay --, or -- said water -- further comprising.

In claims 14 and 15, it is unclear on what the ratio is based, e.g., weight/weight, moles/moles, weight/volume, volume/volume.

Claim 18 is indefinite because it is unclear because it refers to the material conforming to the formula of claim 1. Claim 1 further includes clay and water which at least clay is a further ingredients in claim 20 which is dependent on claim 18. It is unclear what is the scope of claim 18 and 20.

Claims 22 and 24 are indefinite because said claims refer both to claim 21 and claim 1.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/US01/00276PCT/US01/11111**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Claims 18-19, 25-29 and 35-41 lack novelty under PCT Article 33(2) as being anticipated by Norman et al., 3,948,809. Norman et al (examples, claims, and column 2, line 25) discloses the calcination of bauxite waste liquors after addition of sodium carbonate or sodium hydroxide at temperatures of 400o C to 900o C. Said disclosure reads on the compositions and processes.

Claims 1-4, 7, 10, 14 and 18-23 lack an inventive step under PCT Article 33(3) as being obvious over Burba, III et al., US 5,232,627, taken with Martin et al., US 5,728,363.

Burba, III et al '627 (column 2, lines 4 et seq; example 7; and claim 27) discloses making clay adducts with natural and synthetic hydrotalcites characterized as AHMMO. Said adducts are taught as rheological agents in aqueous compositions. Burba, III et al '627 (column 2, lines 16 et seq) discloses naturally occurring hydrotalcites contain some CO<sub>2</sub> in its structure which when thermally dehydrated yields an active magnesium aluminum oxide compound or oxyhydroxide compound. Burba, III et al '627 (example 7) teaches the compositions characterized as clay adducts with spinals activated above 500° C. Burba, III et al '627 (column 4, lines 10 et seq) teaches formula which patentees disclosed as the crystalline mixed metal hydroxides (MMOH) used to create the mixed metal oxides or oxy-hydroxides (AHMMO) have a structure having a value of "(2m + 3n + qa + br)" equal to or more than 3.

Burba, III et al '627 differs from the claims in the lack of the explicit structure set forth in the instant claims having a value of "(2m + 3n + qa + br)" of less than 3. To the extent the Burba, III et al '627 AHMMO materials differ from the instantly claimed materials in the value of "(2m + 3n + qa + br)", said materials would have been obvious to one having ordinary skill in the art at the time of applicant's invention as an oxy-hydroxide or as a known activated hydrotalcite additive known in the art.

Martin et al (abstract; columns 3 and 4; column 5, line 12; and examples) discloses methods of making hydrotalcites and hydrotalcite-like products and characterizes (column 1, lines 18 et seq) said hydrotalcites as layered double hydroxides. Martin et al (column 5, line 12) discloses the hydrotalcites and hydrotalcite-like products are useful as viscosity/rheology control agents.

Martin et al differs from the claims in an explicit disclosure of an aqueous clay composition employing the Martin et al hydrotalcites.

These references are combinable because they teach calcined or activated hydrotalcites and associated structures. It would not involve an inventive step to employ the calcined hydrotalcites of Martin et al in the compositions of Burba, III et al '627 as an obvious art known activated hydrotalcites as taught in the Martin et al reference.

Furthermore, it would not involve an inventive step to employ the compositions of Burba, III et al '627 as art known viscosity/rheology control agent compositions which the Martin et al materials are taught to be useful.

Claims 1-10, 14 and 16-24 lack an inventive step under PCT Article 33(3) as being obvious over Burba, III et al., US 5,232,627, in view of Misra, US 4,656,156.

Burba, III et al '627 (column 2, lines 4 et seq; example 7; and claim 27) discloses making clay adducts with natural and synthetic hydrotalcites characterized as AHMMO. Said adducts are taught as rheological agents in aqueous compositions. Burba, III et al '627 (column 2, lines 16 et seq) discloses naturally occurring hydrotalcites contain some CO<sub>2</sub> in its structure which when

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/US01/00276PCT/US01/11111**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

thermally dehydrated yields an active magnesium aluminum oxide compound or oxyhydroxide compound. Burba, III et al '627 (column 2, lines 43-47) teaches activating other metal compounds such as salts may require higher temperatures, more time, more atmospheric oxygen and/or OH<sup>-</sup> ions.

Burba, III et al '627 differs from the claims in the lack of the explicit structure set forth in the instant claims having a value of "(2m + 3n + qa + br)" of less than 3. To the extent the Burba, III et al '627 AHMMO materials differ from the instantly claimed materials in the value of "(2m + 3n + qa + br)", said materials would have been obvious to one having ordinary skill in the art at the time of applicant's invention as an oxy-hydroxide or as a known activated hydrotalcite additive known in the art.

Misra (abstract) discloses making activated synthetic hydrotalcite from industrial Bayer liquor. Misra (column 4, lines 35 et seq) discloses activating the compositions from about 500°C to 600°C in a rotary calciner.

Misra (column 5, lines 5 et seq) teaches adding the magnesium hydroxide to a solution containing ions of aluminate, carbonate, and hydroxide; such as those containing alkali hydroxide, alkali carbonate, and aluminium oxide. Said solutions derived from the Bayer process liquor in making alumina from bauxite.

These references are combinable because they teach activated hydrotalcite and clay adducts employing activated hydrotalcites. It would not involve an inventive step to employ the Misra activated hydrotalcites in the compositions of Burba, III et al '627 as an art known activated hydrotalcite.

Claims 5 and 6 have been included herein since said calcination temperatures for the calcined hydrotalcites have not been shown to be critical. Attention is directed to the instant examples which employ different calcining methods. Merely modifying the process conditions such as temperature and concentration is not a patentable modification absent a showing of criticality.

Claims 11-13 and 15 lack an inventive step under PCT Article 33(3) as being obvious over Burba, III et al., US 5,232,627, taken with Martin et al., US 5,728,363, as applied to claims 1-4, 7 and 11 above, and further in view of SKW TROSTBERG, EP 0 887 396 A, and/or either Watkins et al., US 5,036,915, or Wyganowski, US 5,036,915. SKW TROSTBERG, EP 0 887 396 A, is a patent family member document of Keilhofer et al, US 6,025,303, which is an English language version of SKW TROSTBERG as evidenced by their common priority of DE 197 27 541, filed 28 June 1997.

Burba, III et al '627 and Martin et al disclose viscosity/rheology control agents and compositions as set forth above. Burba, III et al '627 and Martin et al differ from the claims in the further addition of aluminum oxide and the concentration thereof.

SKW TROSTBERG (page 2 and claims) discloses solid based compositions as viscosity/rheology control compositions employing activated hydrotalcites and as component c) at least one solid base including aluminum trihydroxide.

These references are combinable because they teach viscosity/rheology control agents and compositions. It would not involve an inventive step to employ an aluminum hydroxide as disclosed in the SKW TROSTBERG reference as a suitable base material for suitable pH modification.

Watkins et al (abstract; column 4, lines 10 et seq; and column 10, lines 31 et seq) teaches the addition of nitrogen containing compounds as viscosity modifiers in subterranean formations which contain fines including montmorillonites as the most common material encountered. Watkins et al (column 10, lines 31 et seq) teaches suitable nitrogen compounds include ammonium ion precursors which are water soluble and hydrolyze in steam such as urea and thiourea.

Wyganowski (abstract and columns 9 to 10, lines 66 to 20; and column 12, lines 38-50) teaches urea as a rheological for clay compositions and pH modifier.

These references are combinable because they teach rheological clays and additives employed to modify clay compositions and formations. It would not involve an inventive step to employ urea or thiourea as a conventional additive in the Burba, III et al '627 compositions as a rheological or pH modifier for the clays therein.

Claims 1-48 meet the criteria set out in PCT Article 33(2)-(4), because the claimed invention has utility as a thickening agent in well treating compositions.

Claims 30-34 and 42-48 meet the criteria set out in PCT Article 33(2)-(4), because the claimed rheology modification agent prepared by calcining in the temperature range of 750 C to 1,500 C a mixture of hydrotalcite and a sodium compound in combination with a clay and optionally with aluminium oxide a nitrogen compound or a combination of aluminium oxide and a nitrogen compound are not disclosed or fairly taught in the prior art.

## ----- NEW CITATIONS -----

US 3,948,809 A (NORMAN et al.) 06 April 1976 (06.04.1976), see examples claims and column 2, lines 25 et sequa.

IPEA/US 20 JUL 2001

25. A rheology modification agent prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.
26. The agent of Claim 25 wherein the sodium compound is sodium carbonate or a hydrate thereof.
27. The agent of Claim 25 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.
28. The agent of Claim 25 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.
29. The agent of Claim 25 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetylamide, thiourea and mixtures thereof.
30. A rheology-modified composition comprising clay; water; and a rheology modification agent which has been prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.
31. The composition of Claim 30 wherein the sodium compound is sodium carbonate or a hydrate thereof.
32. The composition of Claim 30 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.
33. The composition of Claim 30 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.
34. The composition of Claim 30 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetylamide, thiourea and mixtures thereof.
35. A method of preparing a rheology-modification agent comprising calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a



hydrotalcite-like compound and (b) sodium or a sodium compound; and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

36. The method of Claim 35 wherein the sodium compound is sodium carbonate or a hydrate thereof.

37. The method of Claim 35 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

38. The method of Claim 35 wherein the temperature is from about 800°C to about 1100°C.

39. The method of Claim 35 wherein the aluminum oxide is selected from the group consisting of boehmite, gibbsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

40. The method of Claim 35 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetylamine, thiourea and mixtures thereof.

41. The method of Claim 35 wherein the mixture, of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, is a waste stream from bauxite processing.

42. A method of preparing a rheology-modified composition comprising mixing clay, water, and a rheology modification agent which has been prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound; and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

43. The method of Claim 42 wherein the temperature is from about 800°C to about 1100°C.

44. The method of Claim 42 wherein the sodium compound is sodium carbonate or a hydrate thereof.

45. The method of Claim 42 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

46. The method of Claim 42 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

47. The method of Claim 42 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetylamide, thiourea and mixtures thereof.

48. The method of Claim 42 wherein the mixture, of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, is a waste stream from bauxite processing.

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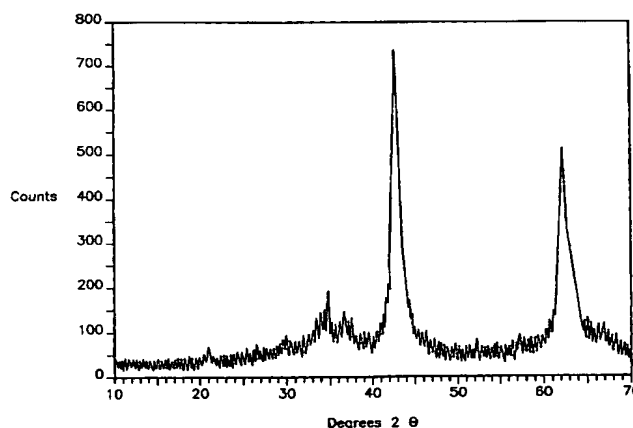
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RHEOLOGY MODIFIED COMPOSITIONS AND MODIFICATION AGENTS



(57) Abstract: A method of making a rheology modified aqueous composition, particularly useful for drilling, milling and mining applications, is disclosed. The method includes admixing, with a clay and water, a material or materials whose constituents substantially conform to the proportions of the empirical formula  $M'_m M''_n (OH)_{(2m+3n+qa+br)} (A^q)_a (B^r)_b \cdot xH_2O$ , where  $M'$  represents at least one divalent metal cation and  $m$  is an amount of from greater than zero to about 8; where  $M''$  represents at least one trivalent metal cation and  $n$  is an amount of from greater than zero to about 6; where  $A$  is an anion or negative-valence radical that is monovalent or polyvalent, and  $a$  is an amount of  $A$  ions of valence  $q$ , provided that if  $A$  is monovalent,  $a$  is from greater than zero to about 8, and if  $A$  is polyvalent,  $a$  is from greater than zero to about 4; where  $B$  is a second anion or negative-valence radical that is monovalent or polyvalent, and where  $b$  is an amount of  $B$  ions of valence  $r$  and  $b$  is from zero to about 4; provided  $(m+n)$  is greater than or equal to 1; further provided that  $qa+br$  cannot be greater than  $2m+3n$  and provided that  $qa$  cannot equal  $2m+3n$ ; and still further provided that  $(2m+3n+qa+br)$  is less than 3; and where  $xH_2O$  represents excess waters of hydration, with  $x$  being zero or more. Calcined hydrotalcite and hydrotalcite-like materials are particularly preferred as starting materials. Optionally, an aluminum oxide, a nitrogen-containing compound, or both may be added. The resulting composition is preferably an elastic solid exhibiting stress-dependent fluidity, desirable temperature resistance, inhibition of reactivity, relatively low cost, and pressure resistance. A dry composition and method of making are also disclosed.

WO 01/49406 A1

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/00276

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B01J 13/00; C01B 33/20; C04B 33/04  
US CL : 516/110; 507/129, 131, 140, 239, 244, 269; 252/184

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 516/110; 507/129, 131, 140, 239, 244, 269; 252/184

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,232,627 A (BURBA, III et al) 03 August 1993 (03.08.1993), see entire document.	1-4, 10, 14, 16-17, 19, 21, and 23-24 ----- 5-9, 11-13, 15, 18, 20 and 22
Y	US 5,728,363 A (MARTIN et al) 17 March 1998 (17.03.1998), abstract; columns 3 and 4; column 5, line 12; and examples.	1-4, 10, 14, 19, 21 and 23
Y	US 4,656,156 A (MISRA) 07 April 1987 (07.04.1987), abstract; column 4, lines 35 et sequa.	1-10, 16-19, 21-24
X, P --- Y, P	US 6,025,303 A (KEILHOFER et al) 15 February 2000 (15.02.2000) column 1; column 2, line 48; and claims.	19-20 ----- 1-4, 10-12, 14-18, 21-24,
X --- Y	EP 0 887 396 A1 (SKW TROSTBERG) 30 December 1998 (30.12.1998) abstract; page 1, line 27, page 3, lines 12-16; and claims.	19-20 ----- 1-4, 10-12, 14-18, 21-24

☒ Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/00276

## C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,036,915 A (WYGANOWSKI) 06 August 1991 (06.08.1991) abstract; column 9 to 10; lines 66 to 20; column 12, lines 38-50.	11, 13, 15, 21-24
Y	US 4,580,633 A (WATKINS et al) 08 April 1986 (08.04.1986) abstract; column 4, lines 10 et sequa; column 10, lines 31 et sequa.	11, 13, 15, 21-24
A	US 4,748,139 A (BURBA, III) 31 May 1988 (31.05.1988) see entire document.	1 and 19
A	US 4,664,843 A (BURBA, III et al) 12 May 1987 (12.05.1987) see entire document.	1-4, 10, 14, 19 and 21

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/00276

**Continuation of B. FIELDS SEARCHED Item 3: EAST, CAS ONLINE**  
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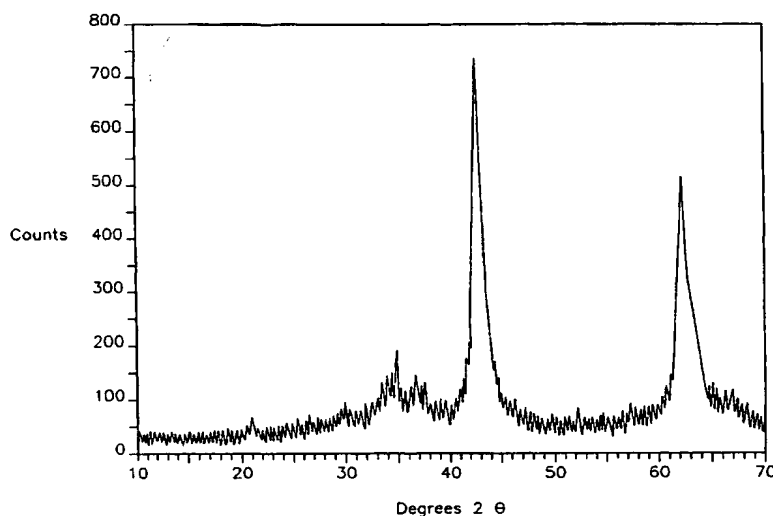
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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: RHEOLOGY MODIFIED COMPOSITIONS AND MODIFICATION AGENTS



(57) Abstract: A method of making a rheology modified aqueous composition, particularly useful for drilling, milling and mining applications, is disclosed. The method includes admixing, with a clay and water, a material or materials whose constituents substantially conform to the proportions of the empirical formula  $M'_m M''_n (OH)_{(2m+3n+qa+br)} (A^q)_a (B^r)_b \cdot x H_2O$ , where  $M'$  represents at least one divalent metal cation and  $m$  is an amount of from greater than zero to about 8; where  $M''$  represents at least one trivalent metal cation and  $n$  is an amount of from greater than zero to about 6; where  $A$  is an anion or negative-valence radical that is monovalent or polyvalent, and  $a$  is an amount of  $A$  ions of valence  $q$ , provided that if  $A$  is monovalent,  $a$  is from greater than zero to about 8, and if  $A$  is polyvalent,  $a$  is from greater than zero to about 4; where  $B$  is a second anion

or negative-valence radical that is monovalent or polyvalent, and where  $b$  is an amount of  $B$  ions of valence  $r$  and  $b$  is from zero to about 4; provided  $(m+n)$  is greater than or equal to 1; further provided that  $qa+br$  cannot be greater than  $2m+3n$  and provided that  $qa$  cannot equal  $2m+3n$ ; and still further provided that  $(2m+3n+qa+br)$  is less than 3; and where  $xH_2O$  represents excess waters of hydration, with  $x$  being zero or more. Calcined hydrotalcite and hydrotalcite-like materials are particularly preferred as starting materials. Optionally, an aluminum oxide, a nitrogen-containing compound, or both may be added. The resulting composition is preferably an elastic solid exhibiting stress-dependent fluidity, desirable temperature resistance, inhibition of reactivity, relatively low cost, and pressure resistance. A dry composition and method of making are also disclosed.

WO 01/49406 A1

## AMENDED CLAIMS

[received by the International Bureau on 21 June 2001 (21.06.01);  
new claims 25-48 added; remaining claims unchanged (3 pages)]

25. A rheology modification agent prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

26. The agent of Claim 25 wherein the sodium compound is sodium carbonate or a hydrate thereof.

27. The agent of Claim 25 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

28. The agent of Claim 25 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

29. The agent of Claim 25 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetamide, thiourea and mixtures thereof.

30. A rheology-modified composition comprising clay, water, and a rheology modification agent which has been prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound; and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

31. The composition of Claim 30 wherein the sodium compound is sodium carbonate or a hydrate thereof.

32. The composition of Claim 30 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

33. The composition of Claim 30 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

34. The composition of Claim 30 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetamide, thiourea and mixtures thereof.

35. A method of preparing a rheology-modification agent comprising calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a



hydrotalcite-like compound and (b) sodium or a sodium compound; and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

36. The method of Claim 35 wherein the sodium compound is sodium carbonate or a hydrate thereof.

37. The method of Claim 35 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

38. The method of Claim 35 wherein the temperature is from about 800°C to about 1100°C.

39. The method of Claim 35 wherein the aluminum oxide is selected from the group consisting of boehmite, gybsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

40. The method of Claim 35 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetamide, thiourea and mixtures thereof.

41. The method of Claim 35 wherein the mixture, of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, is a waste stream from bauxite processing.

42. A method of preparing a rheology-modified composition comprising mixing clay; water; and a rheology modification agent which has been prepared by calcining at a temperature of at least about 750°C a mixture of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound; and, optionally thereafter, admixing therewith an aluminum oxide, a nitrogen-containing compound, or a combination thereof.

43. The method of Claim 42 wherein the temperature is from about 800°C to about 1100°C.

44. The method of Claim 42 wherein the sodium compound is sodium carbonate or a hydrate thereof.

45. The method of Claim 42 wherein the sodium is present in a concentration of from greater than about 1,000 ppm to about 100,000 ppm.

46. The method of Claim 42 wherein the aluminum oxide is selected from the group consisting of boehmite, gibbsite, and amorphous aluminum oxides exhibiting chi or rho orientation.

47. The method of Claim 42 wherein the nitrogen-containing compound is selected from the group consisting of urea, propionamide, acetamide, thiourea and mixtures thereof.

48. The method of Claim 42 wherein the mixture, of at least (a) hydrotalcite or a hydrotalcite-like compound and (b) sodium or a sodium compound, is a waste stream from bauxite processing.